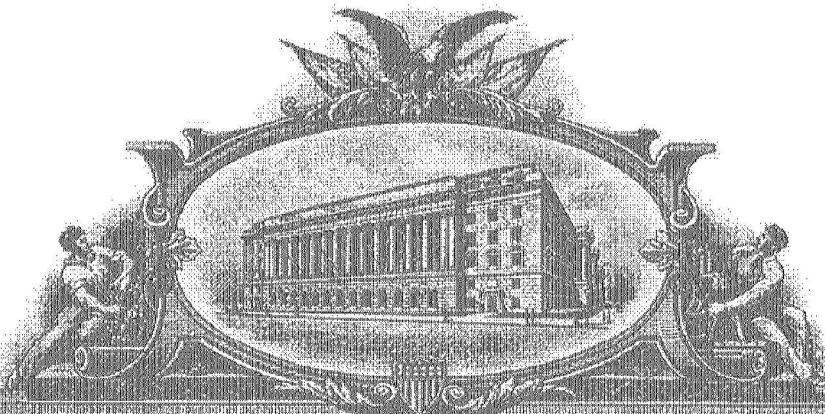


EXHIBIT K

8069998



THE UNITED STATES OF AMERICA

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United States Patent and Trademark Office

November 06, 2020

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**APPLICATION NUMBER: 10/073,931
FILING DATE: February 14, 2002
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ISSUE DATE: November 17, 2009**



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**Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office**

EVOLUTION TOWARDS TRANSPARENT OPTICAL NETWORKS USING SELECTIVE WAVELENGTH REGENERATION AND CONVERSION

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Abstract: In this paper we introduce the concept of transparent OXCs exploiting selective wavelength regeneration as a building block for ultra long-haul optical networks. Depending on the maximum transparency length, the node can be equipped with the suitable amount of regeneration. In this paper we study the relationship between increased transparency length and amount of regeneration required for different network topologies and traffic patterns.

1. Introduction

The initial vision of the all-optical network consisted of the combination of WDM line systems and optical switching technology, managing end-to-end lightpaths [1]. This optical layer was proposed to cope with traffic growth and brings tremendous cost savings by exploiting both optical amplifiers and optical bypass in intermediate nodes. However, optical impairments limit current transmission distances to 600km, slowing down the evolution towards this all-optical network. Therefore, intermediate solutions based on the opaque network concept (in which signals are electrically regenerated at each intermediate node) are used today to overcome these limitations [2].

Recent advances in WDM transmission technology promise unregenerated transmission distances up to 2000-3000 km. This gives new opportunities for deploying a truly optical layer. Today, two main options exploiting such ultra long-haul transmission are envisaged: 'Islands of Transparency' and 'Maximum Transparency Length' [3]. Islands of transparency are subnetworks with internal transparency, while O/E/O conversion is performed in between these subnetworks. This can be realized with transparent OXCs without regeneration capabilities inside the subnetworks and opaque OXC at the boundaries. The second option exploits selective wavelength regeneration in intermediate nodes along the path each time this is required to overcome transmission length limitations. Therefore, each node of the network is equipped with a hybrid OXC/DXC: a transparent OXC offering full connectivity, connected to a digital cross-connect (DXC) responsible for regeneration and add/drop of local traffic. The DXC is equipped with long-reach lasers connected to the WDM links via the OXC. The lasers are assumed to be tuneable, as such no additional blocking internal to the switch is introduced. Note that in this scenario the WDM line system does not include transponders, only passive multiplexers. As such, selective O/E/O conversion is only performed, if necessary, via the DXC for wavelength regeneration each time the maximum transparency length is passed or for wavelength conversion to solve wavelength contention.

Both proposed architectures have their merits and drawbacks. Islands of transparency rely on a simpler node model: OXC are either completely transparent or opaque. In addition, the network can be engineered independent of the traffic pattern, such that the maximum transparency length is never violated within an island of transparency. On the other hand, in this architecture wavelength regeneration is not always performed at the most optimal locations or it may even be performed unnecessary. The architecture using

a hybrid OXC/DXC allows to perform selective regeneration of channels only when required (when is maximum transparency length is passed). However, this entails a more complex network design. Depending on the maximum transparency length, it is important that the node is equipped with the suitable ratio of regeneration. As such optical channels can be dynamically provisioned through the network, such that strong signals travel transparently through the node, while weak signals are regenerated. In the remainder of this paper we focus on this maximum transparency length concept and related network design aspects. First we discuss the considered node architecture. Next the network modeling approach is discussed, followed by the obtained results for different network topologies and traffic models.

2. Node Architecture

Figure 1 presents the transparent OXC with a bank of regenerators. We assumed a transparent OXC offering full connectivity connected to a digital cross-connect (DXC) responsible for regeneration and add/drop of local traffic. The DXC is equipped with long-reach lasers connected to the WDM links via the OXC. The lasers are assumed to be tuneable, as such no additional blocking internal to the switch is introduced. Note that the WDM line system does NOT include transponders, only passive multiplexers. As such, selective O/E/O conversion is only performed, if necessary, via the DXC for two main purposes:

- Wavelength regeneration each time the maximum transparency length (max_TL) is passed.
- Wavelength conversion (WC) to solve wavelength contention.

Both aspects are discussed in more detail below.

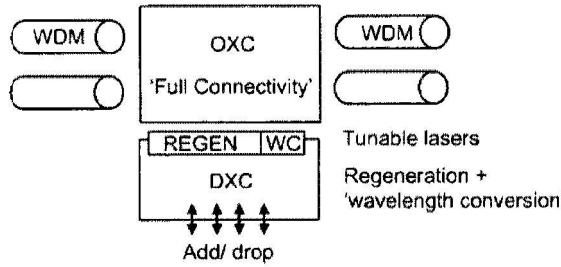


Figure 1: Transparent OXC

Selective Wavelength Regeneration

The driver for selective regeneration is given by the fact that in the opaque scenario an important part of the equipment cost (up to 60-80%) is assigned to the transponders performing O/E/O conversion after each link [3]. By moving this regeneration capability from the WDM link to the OXC's 'backplane' as illustrated in Figure 1 enables to perform the regeneration on a more selective basis, i.e. regenerate only those channels requiring regeneration.

Wavelength Conversion (WC)

In general, performance differences between Wavelength Path (no WC) and Virtual WP (with WC) networks have been found limited, certainly for static traffic patterns [4]. In addition, it has been shown that the performance of VWP can be achieved with a limited amount of wavelength conversion points [5]. When looking at a single connection traversing the network in the transparent reach concept, regeneration is performed each max_TL km. This regeneration cuts the path into subsequent subpaths, hereby adding the freedom to the routing and wavelength assignment (WA) algorithm to assign different wavelengths to the subsequent parts of the path (i.e. the wavelength continuity requirement is restricted to the subpaths). As such the WA problem is relaxed, as WA complexity strongly increases for increasing hop length.

Hence one can wonder on the application of explicit wavelength conversion in intermediate nodes along the path, in addition to the regeneration that contains an implicit wavelength conversion.

2. Modeling

Figure 2 illustrates the algorithmic approach used to model and benchmark the concept of selective wavelength regeneration. The routing algorithm explores the different wavelength planes obeying the maximum transparency length. As such, the algorithm identifies regeneration points along the path each time the maximum transparency length is passed. Note that in these points an implicit wavelength conversion might be performed without an additional cost. The routing algorithm balances between routing cost, per hop, and regeneration cost, per transition between wavelength planes. Note that the approach followed is generic and covers both the 'Islands of transparency' as 'Transparent Reach Length' concept. In the first, the regeneration capabilities are limited to the nodes in between the transparent subnetworks, in the second all nodes contain limited regeneration capabilities. More details on the software platform used can be found at [6].

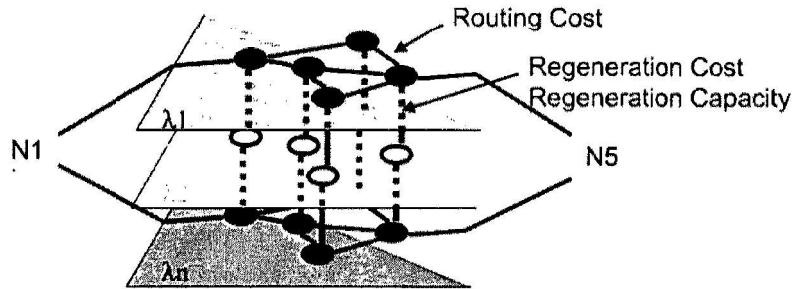


Figure 2: Balancing between routing cost and regeneration cost

3. Results

3.1 Level of Regeneration Required

We applied this approach to a pan-European example network (19 nodes, 32 links, radius of 5000 km) and a USA example network (14 nodes, 23 links, radius of 7500 km). Two kinds of traffic matrices were considered. The first type is based on extrapolations of 'classic' voice traffic. Typically, the major part of the traffic pattern covers physical distances of a few 100 km [7]. The second type of traffic assumes projections for fast growing IP traffic [8]. This traffic is not distance dependent, hence a random traffic matrix is used. Clearly, the average length of the connections for the IP traffic is longer.

The results are presented in Figure 3 and Table 1 (for the European example). We first dimensioned the required capacity of network without taking into account the max_TL limitations. We then evaluated the throughput in the network by applying the routing algorithm as discussed, obeying the max_TL limitations and gradually increasing regeneration capabilities in the nodes. As shown in Figure 3, only a limited amount of paths can be accommodated without regeneration capabilities for max_TL 600 km. Furthermore, the level of required regeneration capabilities according to the max_TL in order to accommodate all connections is found by looking at the intersections of the curves and the X-axis (i.e. the point where 0% of the traffic is blocked). Table 1 gives an overview of these values found for max_TL 600 km (current long-haul WDM), 1200 and 2500 km (ultra long-haul) for both the 'IP' and 'classic' traffic projections.

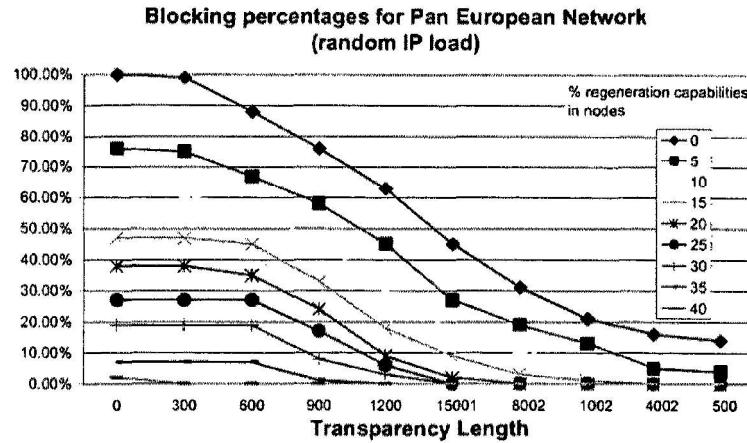


Figure 3: Results for 'IP' load on pan-European network

Projections 'Voice' Traffic

As can be seen in table 1, by increasing the transparency length, the amount of O/E/O regeneration can be reduced significantly. A max_TL of 1200 km reduces the O/E/O conversions to 20%, max_TL 2500 km reduces O/E/O to 5%.

Projections IP Traffic

Due to the longer average distance of IP traffic, O/E/O requirement is not yet significantly reduced for max_TL 1200 km. Longer transparent reach distances up to 2500 km reduces the amount of O/E/O conversions to 10%.

Traffic Matrix	Max_TL = 600 km	Max_TL = 1200 km	Max_TL = 2500 km
'Classic voice'	40%	20%	5%
'IP'	40%	35%	10%

Table 1: % Regeneration capability required in nodes for 100% routing throughput

3.2 Detailed Regeneration Bank Dimensioning

While in the previous section we evaluated the network for different ratios of regeneration in the nodes (the amount of regeneration was the same in all nodes), in this section we dimension the amount of regenerators needed in the individual nodes and links of the network (regeneration dimensioning different for each node) for both the European and USA example. Table 2 gives an overview of the results. For a maximum transparency length of 600, 1500 and 2500 km, the table presents the evolution in the regeneration requirement in the nodes (in-node), in mid-stage regenerator sites on the links (in-line), the total amount of regeneration in nodes and links, and the ratio of transit traffic that is regenerated in the nodes (RTR).

Max_TL	600	1500	2500	Max_TL	600	1500	2500
In-node	190	129	54	In-node	284	91	17
In-line	302	48	0	In-line	340	6	0
Total	492	177	54	Total	624	97	17
RTR (%)	37%	25%	10%	RTR (%)	36%	11%	2%
Reduction	In-node	32.1%	58.1%	Reduction	In-node	68.0%	81.3%
	In-line	84.1%	100.0%		In-line	98.2%	100.0%
	Total	64.0%	69.5%		Total	84.5%	82.5%

Table 2: Evolution of regeneration requirement for increasing maximum transparency length

Observations:

On the USA example (left table), due to the long links in the network, the first opportunities for the ULH systems is to reduce significantly the amount of in-line regeneration (84%). Also the in-node regeneration requirements are reduced, but less significant (32%). When we look at the regeneration requirements per node in more detail, we can clearly identify a number of transit nodes (in which the major part of the traffic is transit) with a high RTR (>50%). These nodes are excellent candidates for opaque nodes. If we would apply the transparent OXC architecture of Figure 1 with selective regeneration, the large regeneration bank would significantly contribute to the OXC size and the total cost. Hence we conclude that in this scenario, opaque nodes are better suited to surround the long links. Consequently this drives the network architecture to a mix of opaque and transparent nodes, which is the aforementioned islands of transparency approach.

For the European example (right table), both the in-line and in-node regeneration requirements are significantly reduced for increasing MAX_TL (68% and 98%). In more detail, looking at the regeneration for an individual node unveils that on average transit nodes can be identified with a regeneration ratio of 10 to 25%. Hence, the European example network (that is a more densely meshed network with shorter links than the US network) is better suited to apply the transparent OXC concept with selective regeneration than the islands of transparency approach.

3.3 Regeneration versus wavelength conversion

The O/E/O conversions in intermediate nodes are performed for 2 reasons, regeneration and wavelength conversion (WC). Depending on the maximum transparency length, the needs for both reasons are different. In our study, to avoid unnecessarily wavelength transitions at each regeneration point, a cost penalty is added in case the regeneration devices are used for WC. Dynamic traffic conditions were emulated by imposing a number of subsequent changes in the traffic pattern. We performed 5 consecutive runs that made random changes to 20% of the traffic pattern. The changes are proportional with the traffic pattern (i.e. a connection with capacity 2 is having twice as much chance to be changed opposed to a connection with capacity 1). Under static traffic conditions, only limited regeneration units are used to perform in addition to the regeneration a wavelength transition (5-10%). Under dynamic traffic conditions, having the capability to perform WC increases network performance more significantly. In this case, between 10 and 30% of the regeneration units are used to perform a WC in order to maintain a flexible and performant network.

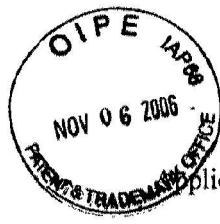
4. Conclusions

In this paper we proposed a network architecture exploiting ultra long-haul transmission systems combined with transparent OXCs with selective regeneration capabilities. The trade-off between increased transparency length and reduced O/E/O regeneration cost has been studied. It has been shown that ULH systems do not only reduce the amount of regeneration requirements on the links but also in the

transit nodes. In particular distance independent IP traffic has shown to be an important driver for an increased transparency length, thereby reducing significantly the regeneration requirements and the transmission cost per bit. The concept of transparent OXCs with selective regeneration has shown to be particularly interesting for European-style networks, which are more densely meshed and consist of shorter links than their US counterparts. For US networks, selective regeneration can be achieved by using the islands of transparency approach. Finally, the impact of selective wavelength conversion has been studied. In particular for networks with increased maximum transparency length and dynamic traffic, it has been shown that a larger percent of the regenerators is also used as wavelength converters to resolve wavelength contentions.

5. References

- [1] A. Saleh, "Transparent Optical Networks for the Next-Generation Information Infrastructure", OFC'95, San Diego, p.241, 1995.
- [2] K. Bala, R.R. Cordell and E. L. Goldstein "The case for Opaque Multiwavelength Optical Networks", IEEE LEOS Summer Topical Meeting Keystone (CO), August 1995.
- [3] Anurag Dwivedi et all, "Value of Reach Extension in Long-Distance Networks", NFOEC2000, Denver, August 2000
- [4] J. M. Yates, M.P. Rumsewicz, and J.P.R. Lacey, "Wavelength Converters in Dynamically-Reconfigurable WDM Networks", IEEE Communications Surveys, vol. 2, no. 2, second quarter 1999.
- [5] W. Van Parys et all, "Meshed Wavelength Division Multiplexed Networks partially equipped with wavelength converters", OFC'98, San Jose, CA, Feb 22-27, 1998
- [6] WDMNetDesign tool, <http://www.comsof.com>
- [7] M. Sinclair, "Improved model for European international telephony traffic," Electron. Lett., vol. 30, pp 1468-1470, 1994.
- [8] A. Dwivedi, R. Wagner, "Traffic Model for USA Long-distance Optical Network", OFC2000, Baltimore, March 2000

**PATENT****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 10/073,931

Filing Date: February 14, 2002

Applicant: Bharat Tarachand DOSHI et al.

Group Art Unit: 2873

Examiner: Evelyn A. Lester

Title: METHODS AND DEVICES FOR PROVIDING OPTICAL SERVICED-ENABLED CROSS-CONNECTIONS

Attorney Docket: 129250-000950/US

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 Alexandria, VA 22314

November 6, 2006

Mail Stop Amendment**AMENDMENT**

Sir:

In response to the Office Action mailed October 4, 2006, the following remarks are respectfully submitted. A listing of claims begins on page 2 of this paper. Remarks begin on page 4 of this paper.

	Claims remaining after Amendment		Highest number previously paid for		Present extra
Total	18	-	20	=	0
Independent	3	-	3	=	0

Application No. 10/073,931
Docket No. 129250-000950/US

IN THE CLAIMS

The following is a complete listing of claims with a status identifier in parenthesis.

LISTING OF CLAIMS

1. (Previously Presented) A connection device comprising:
one or more non-dedicated, processing units; and
an optical switch for receiving Ultra-Long Haul (ULR) optical signals and for connecting at least one of the units to one or more of the received signals based on a characteristic of each signal.
2. (Original) The device as in claim 1 wherein the at least one unit comprises a Raman pump.
3. (Original) The device as in claim 1 wherein the at least one unit comprises an optical-to-electrical-to-optical regenerator.
4. (Original) The device as in claim 1 wherein the at least one unit comprises a dispersion equalization/compensation unit.
5. (Original) The device as in claim 1 where the at least one unit comprises a performance monitor.
6. (Previously Presented) A router comprising:
one or more non-dedicated, processing units; and
an optical switch for receiving Ultra-Long Haul (ULR) optical signals and for connecting at least one of the units to one or more of the received signals based on a characteristic of each signal.
7. (Original) The router as in claim 6 wherein the at least one unit comprises a Raman pump.

Application No. 10/073,931
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8. (Original) The router as in claim 6 wherein the at least one unit comprises an optical-to-electrical-to-optical regenerator.

9. (Original) The router as in claim 6 wherein the at least one unit comprises a dispersion equalization/compensation unit.

10. (Original) The router as in claim 6 wherein the at least one unit comprises a performance monitor.

11. (Previously Presented) A method for providing an optical, service-enabled connection comprising:

receiving Ultra-Long Haul (ULR) optical signals; and
connecting at least one of a number of non-dedicated, processing units to one or more of the received optical signals based on a characteristic of each signal.

12. (Original) The method as in claim 11 wherein the at least one unit comprises a Raman pump.

13. (Original) The method as in claim 11 wherein the at least one unit comprises an optical-to-electrical-to-optical regenerator.

14. (Original) The method as in claim 11 wherein the at least one unit comprises a dispersion equalization/compensation unit.

15. (Original) The method as in claim 11 wherein the at least one unit comprises a performance monitor.

16. (Previously Presented) The device as in claim 1 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a re-shape and re-amplify without retiming unit (“2R unit”), a re-shape and re-amplify with retiming unit (“3R unit”), a Simple Data Link (SDL) unit and a SONET/SDH unit.

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Docket No. 129250-000950/US

17. (Previously Presented) The router as in claim 6 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a 2R unit, a 3R unit, a SDL unit and a SONET/SDH unit.
18. (Previously Presented) The method as in claim 11 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a 2R unit, a 3R unit, a SDL unit and a SONET/SDH unit.

Application No. 10/073,931
Docket No. 129250-000950/US

REMARKS

A. The Section 112, First Paragraph Rejections

(i) Ultra Long Reach Networks Existed at the Time the Present Application Was Filed

Claims 1-18 were rejected based on 35 U.S.C. §112, first paragraph, the Examiner taking the position that because the specification states in one place that Ultra Long Reach (ULR) optical networks are “in the planning stages or just being built” that the Applicants could not have had possession of their claimed inventions at the time the present application was filed. The Applicants respectfully disagree and traverse these rejections for at least the following reasons.

Initially, Applicants note that one of ordinary skill in the art upon reading the instant specification would realize that ULR networks were indeed built and installed as of February 14, 2002; the filing date of the instant application.

Further, the Examiner has ignored the text in paragraphs [0002] through [0007] where the Applicants explain: (a) the ability of ULR networks to transmit optical signals over long distances; (b) the advantages offered by ULR networks; and (c) the shortcomings of existing cross-connections used in existing ULR networks. All of the information in (a) through (c) was realized by the Applicants precisely because ULR networks had already been built, at least to the extent necessary for the Applicants to have realized the shortcomings of existing cross connections and to conceive and develop solutions to these shortcomings (i.e., their claimed inventions). The Applicants respectfully submit that the Examiner’s position strains credulity. If the Examiner has evidence that establishes that ULR networks were not built at the time of the filing of the present application, then the Applicants respectfully request that such evidence be

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Docket No. 129250-000950/US

set forth in an affidavit or the like. Otherwise, the Applicants respectfully request withdrawal of the rejections and allowance of claims 1-18.

(ii) The Specification Discloses Non-Dedicated Processing Units

Claims 1-18 were also rejected based on 35 U.S.C. §112, second paragraph, the Examiner taking the position that the specification does not describe the processing units as “non-dedicated”. The Applicants respectfully disagree and traverse these rejections for at least the following reasons.

The last line of paragraph [0021] states as follows: “Whatever the case, none of the units 51-m are solely dedicated to one link.” (underlining added) This statement clearly indicates that the units are non-dedicated.

Accordingly, the Applicants respectfully request withdrawal of the rejections and allowance of claims 1-18.

B. The Section 112, Second Paragraph Rejections

Dependent claims 16-18 were rejected based on 35 U.S.C. §112, second paragraph the Examiner stating that it is “unclear what the group elements” in these claims “actually is”. Applicants disagree and traverse these rejections.

Initially, the Applicants note that the Examiner’s rejections are unclear. Are the terms unclear to the Examiner? What is the Examiner having a problem understanding?

Each of dependent claims 16-18 contain the phrase: “wherein the at least one unit is selected from the group consisting of”. The reference to “unit” in this phrase refers back to an earlier claim (1, 6 or 11) which uses the term “processing unit”. Thus, the Applicants respectfully submit that the “group” referred to in claims 16-18 clearly indicates a group of processing units.

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Docket No. 129250-000950/US

Accordingly, the Applicants respectfully request withdrawal of the rejections and allowance of claims 16-18.

C. The Section 102 Rejections

Claims 1, 4-6, 9-11, 14 and 15 were rejected under 35 U.S.C. 102(b) as being allegedly anticipated by Fee et al., U.S. Patent 5, 726,788, (hereinafter “Fee”). Applicants disagree and traverse these rejections.

Applicants respectfully submit that Fee fails to teach or suggest a connection device that comprises an optical switch that receives ULR optical signals and connects at least one non-dedicated processing unit to one or more of the received signals based on a characteristic of each signal as in claim 1 and its dependent claims.

In contrast, Fee is silent with respect to the type of optical signals involved. Further, Applicants believe that Fee is not directed towards ULR signals because it repeatedly discloses the need for amplification of an optical signal by an amplifier 210 before the signal is input into an optical interface 208 or backplane 308 which, in turn, are connected to functional units 302. It is a characteristic of ULR signals that amplification is not always required; the opposite of the signals disclosed in Fee.

In addition, it does not appear that Fee discloses non-dedicated processing units. Though Fee’s functional units 302 can apparently handle more than one optical signal (though that fact is not altogether clear from a reading of Fee), the units appear to be dedicated to a limited set of signals. In contrast, the processing units in the claims of the present invention are not dedicated to any one or more optical signals. Because of this, the claimed processing units can be used to

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improve the characteristics of hundreds, if not thousands, of optical signals (see the specification, paragraph 28).

Because Fee does not teach each and every feature of the claimed inventions, Fee cannot provide a basis for a rejection under 35 U.S.C. §102. Withdrawal of the rejections and allowance of claims 1, 4-6, 9-11, 14 and 15 is respectfully requested.

D. The Section 103 Rejections

Claims 2, 7 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fee in view of Wong et al., US Patent 6,624,927 (hereinafter “Wong”). Claims 3, 8 and 13 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fee in view of Sharma et al. US Patent 6,331,906 (hereinafter “Sharma”). Applicants respectfully disagree and traverse these rejections for at least the following reasons.

Claims 2, 3, 7, 8, 12 and 13 are allowable at least because these claims depend from allowable claims 1, 6 and 11 for the reasons set forth above as well as on their own merits.

Accordingly, Applicants respectfully request withdrawal of the pending rejections and allowance of claims 2, 3, 7, 8, 12 and 13.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John E. Curtin at the telephone number listed below.

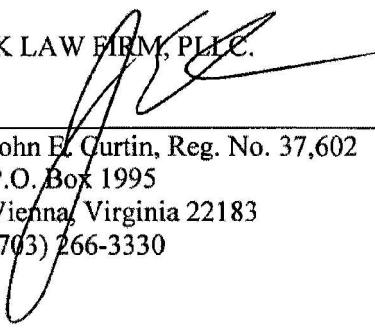
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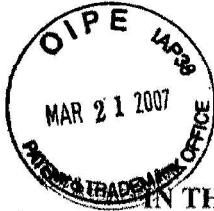
If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 50-3777 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

CAPITOL PATENT & TRADEMARK LAW FIRM, PLLC.

By


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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/073,931

Filing Date: February 14, 2002

Applicant: Bharat Tarachand DOSHI et al.

Group Art Unit: 2873

Examiner: Evelyn A. Lester

Title: METHODS AND DEVICES FOR PROVIDING OPTICAL SERVICED-ENABLED CROSS-CONNECTIONS

Attorney Docket: 129250-000950/US

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March 21, 2007

REQUEST FOR RECONSIDERATION

Sir:

In response to the Final Office Action mailed January 25, 2007 the following remarks are respectfully submitted. A listing of claims begins on page 2 of this paper. Remarks begin on page 5 of this paper.

	Claims remaining after Amendment		Highest number previously paid for		Present extra
Total	18	-	20	=	0
Independent	3	-	3	=	0

Application No. 10/073,931
Docket No. 129250-000950/US

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3. (Original) The device as in claim 1 wherein the at least one unit comprises an optical-to-electrical-to-optical regenerator.
4. (Original) The device as in claim 1 wherein the at least one unit comprises a dispersion equalization/compensation unit.
5. (Original) The device as in claim 1 where the at least one unit comprises a performance monitor.
6. (Previously Presented) A router comprising:
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an optical switch for receiving Ultra-Long Haul (ULR) optical signals and for connecting at least one of the units to one or more of the received signals based on a characteristic of each signal.
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10. (Original) The router as in claim 6 wherein the at least one unit comprises a performance monitor.

11. (Previously Presented) A method for providing an optical, service-enabled connection comprising:

receiving Ultra-Long Haul (ULR) optical signals; and
connecting at least one of a number of non-dedicated, processing units to one or more of the received optical signals based on a characteristic of each signal.

12. (Original) The method as in claim 11 wherein the at least one unit comprises a Raman pump.

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15. (Original) The method as in claim 11 wherein the at least one unit comprises a performance monitor.

16. (Previously Presented) The device as in claim 1 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a re-shape and re-amplify without retiming unit ("2R unit"), a re-shape and re-amplify with retiming unit ("3R unit"), a Simple Data Link (SDL) unit and a SONET/SDH unit.

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17. (Previously Presented) The router as in claim 6 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a 2R unit, a 3R unit, a SDL unit and a SONET/SDH unit.

18. (Previously Presented) The method as in claim 11 wherein the at least one unit is selected from the group consisting of: a gigabit Ethernet unit, a 2R unit, a 3R unit, a SDL unit and a SONET/SDH unit.

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Docket No. 129250-000950/US

REMARKS

A. The Section 112, First Paragraph Rejections

The Applicants appreciate the Examiner's withdrawal of many of the previous Section §112 rejections.

In the instant Office Action the Examiner maintains only the 35 U.S.C. §112, second paragraph, rejections of claims 16-18. The Examiner states that it is "unclear what the group elements" in these claims "actually is". Further, the Examiner states that "there appears to be no infused meaning by the grouping of these elements" and that the grouping is confusing in light the elements in other claims. The Applicants respectfully disagree and traverse these rejections for at least the following reasons.

Each of dependent claims 16-18 contain the phrase: "...wherein the at least one unit is selected from the group consisting of...". Thereafter, each claim presents a selection of a number of non-dedicated, processing units that may be connected to one or more ULR optical signals by the optical switch set forth in independent claim 1.

The common feature shared by each of the claimed processing units is that each one is: (a) non-dedicated; and (b) connected by the same switch to one or more ULR optical signals.

As far as Applicants can determine, there is no USPTO rule, BPAI or CAFC decision that requires every type of processing unit to be claimed in one dependent claim. Thus, there is no inconsistency in (or rule prohibiting) setting forth some types of processing units in dependent claims 2-4, 7-10, 12-15 and others in claims 16-18. While a particular processing unit may be excluded from a particular dependent claim, it is not excluded from being claimed separately as the Examiner appears to be suggesting.

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Accordingly, the Applicants respectfully request withdrawal of the rejections and allowance of claims 16-18.

B. The Section 102 Rejections

Claims 1, 4-6, 9-11, 14 and 15 were again rejected under 35 U.S.C. §102(b) as being allegedly anticipated by Fee et al., U.S. Patent 5, 726,788, (hereinafter “Fee”). Applicants disagree and traverse these rejections for at least the following reasons.

Applicants again respectfully submit that Fee fails to teach or suggest a connection device that comprises an optical switch that receives ULR optical signals and connects at least one non-dedicated processing unit to one or more of the received signals based on a characteristic of each signal as in claim 1 and its dependent claims.

In contrast, Fee is silent with respect to the type of optical signals involved. Further, Applicants believe that Fee is not directed towards ULR signals because it repeatedly discloses the need for amplification of an optical signal by an amplifier 210 before the signal is input into an optical interface 208 or backplane 308 which, in turn, are connected to functional units 302. It is a characteristic of ULR signals that amplification is not always required; the opposite of the signals disclosed in Fee.

The Examiner takes the position that Fee is directed at ULR signals because Fee “addresses the need for keeping the signal strong”. The Applicants note that this a characteristic of many optical networks, not just ULR networks. Even though a ULR network has such a characteristic, this is not the feature that distinguishes ULR networks over non-ULR networks. In sum, the fact the Fee may keep signals strong is no indication that it is directed at ULR signals or networks.

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The Examiner also states that the Applicants' disclosure supports an interpretation that Fee is directed at ULR signals/networks because the instant specification states that "simple amplification" is used in ULR networks. As the Applicants have stated before, while amplification of an optical signal in a ULR network may sometimes be necessary, it is not always required as are the signals in Fee.

The Examiner's positions notwithstanding, the Applicants respectfully submit that Fee simply is not directed to ULR signals or networks. There is no explicit disclosure of such signals/networks in Fee (as there is in the instant specification) and there is nothing in Fee that would suggest to one skilled in the art that Fee's techniques could be used in ULR networks, unless the required amplification always used in Fee is removed. However, such removal would change Fee's principle of operation which is impermissible (see MPEP §2143.01).

Fee also fails to disclose or suggest non-dedicated processing units. Though Fee's functional units 302 can apparently handle more than one optical signal (though that fact is not altogether clear from a reading of Fee), the units appear to be dedicated to a limited set of signals. In contrast, the processing units in the claims of the present invention are not dedicated to any one or more optical signals. Because of this, the claimed processing units can be used to improve the characteristics of hundreds, if not thousands, of optical signals (see the specification, paragraph 28). Further indication that Fee is dedicated to a set number of signals is the statement in Fee that "multiple input/output switches may be built by cascading basic one-by-one switching blocks" (column 5, lines 38-40). Said another way, because the switch 308 is dedicated to a set number of signals/links, additional switches are needed to service other signals/links.

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The Examiner takes the position that Fee does disclose non-dedicated processing units because an “optical signal can be routed to any one of the functions or processing units”. However, as explained in the Applicants’ last response the specification uses the words “non-dedicated” to mean not dedicated to a single link. The fact that a dedicated set of links in Fee may be connected to any one of its dedicated functional blocks does not make the blocks “non-dedicated” because these blocks can only be used with a limited set of signals.

Because Fee does not teach each and every feature of the claimed inventions, Fee cannot provide a basis for a rejection under 35 U.S.C. §102. Withdrawal of the rejections and allowance of claims 1, 4-6, 9-11, 14 and 15 is respectfully requested.

C. The Section 103 Rejections

Claims 2, 7 and 12 were again rejected under 35 U.S.C. 103(a) as being unpatentable over Fee in view of Wong et al., US Patent 6,624,927 (hereinafter “Wong”). Claims 3, 8 and 13 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fee in view of Sharma et al. US Patent 6,331,906 (hereinafter “Sharma”). Applicants respectfully disagree and traverse these rejections for at least the following reasons.

Claims 2, 3, 7, 8, 12 and 13 are allowable at least because these claims depend from allowable claims 1, 6 and 11 for the reasons set forth above as well as on their own merits. Accordingly, Applicants respectfully request withdrawal of the pending rejections and allowance of claims 2, 3, 7, 8, 12 and 13.

D. Entry of this Request for Reconsideration

Entry of this Request for Reconsideration (“Request”) is solicited because the Request: (a) places the application in condition for allowance for the reasons discussed herein; (b) does not raise any new issues requiring further search and/or consideration; (c) does not present any

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additional claims without canceling the corresponding number of finally rejected claims; and (d) places the application in better form for appeal, if an appeal is necessary.

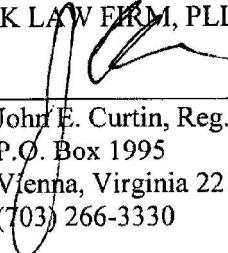
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John E. Curtin at the telephone number listed below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 50-3777 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

CAPITOL PATENT & TRADEMARK LAW FIRM, PLLC.

By


John E. Curtin, Reg. No. 37,602
P.O. Box 1995
Vienna, Virginia 22183
(703) 266-3330



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NOTICE OF ALLOWANCE AND FEE(S) DUE

32498 7590 07/01/2009

CAPITOL PATENT & TRADEMARK LAW FIRM, PLLC
 P.O. BOX 1995
 VIENNA, VA 22183

EXAMINER

LESTER, EVELYN A

ART UNIT PAPER NUMBER

2873

DATE MAILED: 07/01/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/073,931	02/14/2002	Bharat Tarachand Doshi	129250-000950/US	5324

TITLE OF INVENTION: METHODS AND DEVICES FOR PROVIDING OPTICAL, SERVICED-ENABLED CROSS-CONNECTIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	10/01/2009

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

32498 7590 07/01/2009

CAPITOL PATENT & TRADEMARK LAW FIRM, PLLC
P.O. BOX 1995
VIENNA, VA 22183

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/073,931	02/14/2002	Bharat Tarachand Doshi	129250-000950/US	5324

TITLE OF INVENTION: METHODS AND DEVICES FOR PROVIDING OPTICAL, SERVICED-ENABLED CROSS-CONNECTIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	10/01/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
LESTER, EVELYN A	2873	385-016000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).	2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
<input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.	1 _____
<input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2 _____
	3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): Individual Corporation or other private group entity Government

4a. The following fee(s) are submitted:	4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)
<input type="checkbox"/> Issue Fee	<input type="checkbox"/> A check is enclosed.
<input type="checkbox"/> Publication Fee (No small entity discount permitted)	<input type="checkbox"/> Payment by credit card. Form PTC-2038 is attached.
<input type="checkbox"/> Advance Order - # of Copies _____	<input type="checkbox"/> The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/073,931	02/14/2002	Bharat Tarachand Doshi	129250-000950/US	5324
32498	7590	07/01/2009	EXAMINER	
CAPITOL PATENT & TRADEMARK LAW FIRM, PLLC P.O. BOX 1995 VIENNA, VA 22183				LESTER, EVELYN A
ART UNIT		PAPER NUMBER		
2873				DATE MAILED: 07/01/2009

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
 (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 423 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 423 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)
	10/073,931	DOSHI ET AL.
	Examiner	Art Unit
	Evelyn A. Lester	2873

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. This communication is responsive to RCE and amendment filed on 5-26-09.
2. The allowed claim(s) is/are 1,6 and 11.
3. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All
 - b) Some*
 - c) None
 of the:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) hereto or 2) to Paper No./Mail Date _____.
 - (b) including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. Notice of References Cited (PTO-892)
2. Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. Notice of Informal Patent Application
6. Interview Summary (PTO-413),
Paper No./Mail Date _____.
7. Examiner's Amendment/Comment
8. Examiner's Statement of Reasons for Allowance
9. Other _____.

/Evelyn A. Lester/
Primary Examiner, Art Unit 2873

Application/Control Number: 10/073,931
Art Unit: 2873

Page 2

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114 was filed in this application after a decision by the Board of Patent Appeals and Interferences, but before the filing of a Notice of Appeal to the Court of Appeals for the Federal Circuit or the commencement of a civil action. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 5-26-09 has been entered.

REASONS FOR ALLOWANCE

2. The following is an examiner's statement of reasons for allowance:

The prior art does not show or fairly suggest the claimed invention of a connection device and router, with related method having the claimed structure and claimed limitations, wherein a rejection under 35 USC 102 or 103 would be improper. Please particularly note the combination of claimed elements and claimed limitations, including the indicated allowable subject matter given in the office action mailed on 11-16-07, wherein specific optical modules are provided, which are not apparent or taught or suggested by the prior art as recited in the claimed invention. Therefore, in light of the Applicants' arguments and/or amendments, the claimed invention is considered to be in condition for allowance as being novel and nonobvious over the prior art.

Application/Control Number: 10/073,931
Art Unit: 2873

Page 3

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Drawings

3. The drawings were received on 2-14-02. These drawings are acceptable and approved.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evelyn A. Lester whose telephone number is (571) 272-2332. The examiner can normally be reached on M-F, subject to an increased flex schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky L. Mack can be reached on (571) 272-2333. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number: 10/073,931
Art Unit: 2873

Page 4

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Evelyn A. Lester/
Primary Examiner
Art Unit 2873